

Soil Assessment Capabilities



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This Presentation is:
UNCLASSIFIED



Learning Objectives

- Without the aid of references and IAW the material covered in this lesson, the PWTI will describe the soils assessment capabilities available.
- Without the aid of references and IAW the material covered in this lesson, the PWTI will know the appropriate penetration depth these capabilities should be driven for correct readings.



Learning Objectives

- Without the aid of references and IAW the material covered in this lesson, the PWTI will understand the meaning of the acronym CBR.
- Without the aid of references and IAW the material covered in this lesson, the PWTI will describe what these capabilities can do for the MWSS.



Background

- One of the most important properties that a soil possesses is it's shearing resistance or shear strength.
- It is very important in its relation to the supporting strength or bearing capacity of a soil as a base or subgrade beneath a runway or other structure.



- For most applications, the California Bearing Ratio (CBR) value or the unconfined compression strength value of soil is used as a measure of shear strength.
- CBR is determined by a standardized penetration shear test and is used with empirical curves for designing and evaluating unsurfaced, aggregate, surfaced and flexible pavements or roads.



- Both the DCP and SACP described herein will test the CBR strengths of soils. The DCP is capable of measuring CBRs of 1 to well over 100.
- The SACP or ACP is capable of measuring CBR strengths of 1 to 15.



DCP Description

- Consists of a steel rod with a steel cone attached to one end.
- Driven into the pavement or subgrade by means of a sliding dual/single mass hammer.
 - 17.6 lb.
 - 10.1 lb.
- From a height of 22.6 inches





- The cone penetration of one blow of the 17.6 hammer is equivalent to two blows by the 10.1 hammer.
- The 10.1 hammer yields better results in weaker soils - CBR of 10 or less.
- Can be used on soils up to 80 CBR.



Disposable Cone

- Used in soils where the standard cone is difficult to remove.
- Mounts on an adapter.
- Slides off the adapter allowing removal of the DCP device from the soil.





Go No-Go Gauge

- Used to ensure cone base diameter is within proper tolerance.
- Each cone should be checked before and at selected intervals to ensure proper cone diameter.
- The cone is within proper tolerance when it fits into only one end of the gauge.



Basic Unit

- Top rod threaded and welded to the handle.
- Bottom rod threaded and welded to the anvil.
- Vertical scale in centimeters and inches.
- Six hardened 60-degree fixed cones.



Accessories

- Disposable Cone Kit:
 - Four hardened cone adapters.
 - 200 disposable cones.

- Tool Kit:
 - Two pair of channel lock pliers.



Use of the DCP

- Requires a minimum of two people to operate, preferably three.
- One holds the device in the vertical position.
 - The base of the cone must be flush with the surface of the soil.



- Second person checks the device for a zero reading.
 - By holding the vertical scale to prevent it from sinking into the soil.
- The bottom of the hammer should read zero millimeters on the vertical scale.
- Third person records the data.







- In weak soils the weight of the DCP will sink the cone past its zero reading.
- In this case, a zero blow penetration reading is recorded at the actual measured pretest depth.
- In other words if the cone sinks 15mm when placed, that 15mm along with zero blows is recorded.
- The hammer is then raised to the bottom of the handle and dropped.





- Ensure the hammer is touching the handle but not lifting the cone before it is dropped.
- The hammer must be allowed to fall freely
- Operator must be careful not to exert any downward force on the handle after dropping the hammer.



- Both the operator and the recorder keep track of the number of blows between measurements.
- The recorder is responsible for recording the penetration after each set of blows.
- Measurements are recorded to the nearest 5 mm.



- Cone must penetrate a minimum of 25 mm between recorded measurements.
- The number of blows between measurements will vary dependant upon soil strength and cone penetration rate.





- Any noticeable increases in penetration rate indicates a weaker soil layer.
- Should always record the *blow count* and *penetration depth* whenever a weaker soil layer is encountered.
- After the cone has been driven to the desired test depth (36 in), it can be removed from the soil. *Caution must be exercised.*



- Do not try to use force in order to get the device to penetrate the soil vertically.
- The handle must not be allowed to deviate from vertical 6 “or more.
- The test should be stopped and a new test attempted at another location.



Reading Depths in Soil

- Soil strength usually increases with depth.
- Some cases a thin, hard crust will overlay a soft layer.
- Or the soil will contain thin layers of hard and soft materials.
- For this reason it is recommended that each penetration be made to a **depth of 36 inches.**



Charting

Expedient Construction Operations



- CBR values can be determined in an expedient manner using the SACP
- SACP was developed to provide a rapid, simple alternative to the standard CBR test



Indicator Reading and Operation



- One Man Method
- Two Man Method (PREFERRED)



SACP Operation

- Place both hands, palms down, symmetrically on the handles of the instrument
- Apply force with a slow, steady, downward movement
- Read load indicator when base of cone enters the ground (surface reading)
- Read indicator at corresponding depth marks (the shaft is marked in 3-inch intervals)









Primary Concerns While Operating

- Instrument should be kept vertical during operation
- Rate of penetration should be in the range of 1/2 to 1 inch per second



SOIL ASSESSMENT

3 INCH MARK CBR=12

6 INCH MARK CBR=13

9 INCH MARK CBR=14

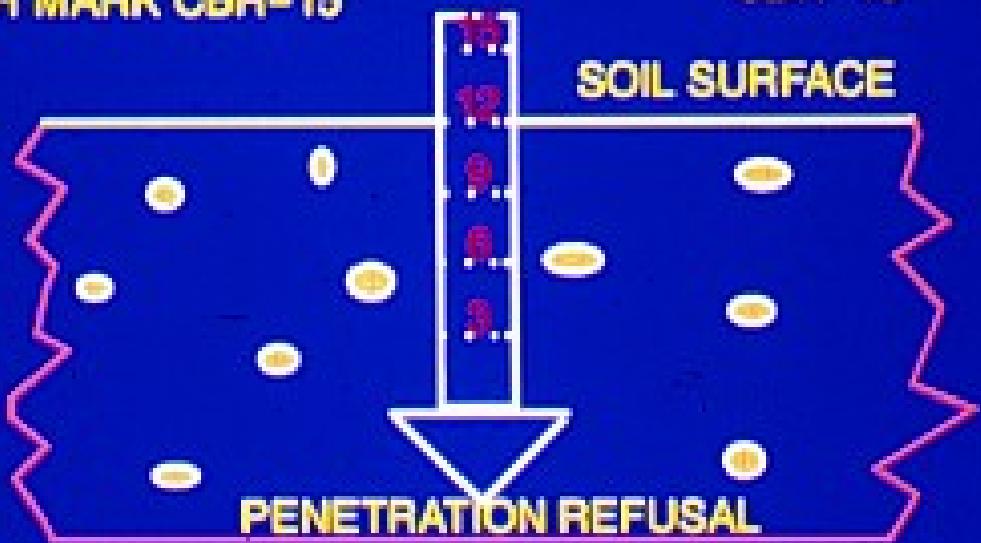
12 INCH MARK CBR=15

READING DIFFERENCE 3

TOTAL 54

AVERAGE 13.5

CBR=13





- Most dry sands and gravel will support AM-2 matting
- A minimum CBR of 4 is required to support AM-2 matting and aircraft operations



WARNING!

- Saturation sands, cohesionless silts, etc., which exist in a “Quick” condition (“0” Strength) must be avoided



Weather Conditions

- Soil conditions are significantly affected by Weather
- Evaluation of soil strength is valid only for the period immediately after the measurements are made



- CBR measurements taken during:
 - Dry conditions, overestimates average soil strength
 - Wet conditions, underestimate average soil conditions



The DCP along with the SACP should provide you a means for sub-layer assessment when determining the trafficability of future/potential airfield sites and access roads.



Summary

- Discussed the background of the DCP/SACP
- Described the DCP/SACP
- Identified their use for expedient construction operations
- Provided a rapid alternative for measuring subgrade soil strength
- Terms and definitions